

# Unit VI

<b>6.</b>	<b>Probability and Statistics</b>
<b>6.1</b>	Elementary Probability: Joint and Conditional probability and Bayes theorem
<b>6.2</b>	Discrete Probability Distributions: Binomial and Poisson
<b>6.3</b>	Continuous Probability Distributions: Exponential and Normal

## Practice work examples

1. A random variable X has the following probability distribution:

X	0	1	2	3	4	5	6	7
P(X=x)	a	4a	3a	7a	8a	10a	6a	9a

- (i) Find the value of a.
  - (ii) Find  $P(X > 3)$ .
2. The probability mass function of a random variable X is zero except at the points  $X=0, 1, 2$ . At these points, it has the values  $P(X = 0) = 3c^3, P(X = 1) = 4c - 10c^2, P(X = 2) = 5c - 1$ .  
Find (i) c, (ii)  $P(X < 1)$ , (iii)  $P(1 < X \leq 2)$ , (iv)  $P(0 < X \leq 2)$
3. The probability that a man aged 60 will live up to 70 is 0.65. What is the probability that out of 10 such men now at 60 at least 7 will live up to 70?
4. 4 coins are tossed simultaneously. What is the probability of getting (i) 2 heads? (ii) at least 2 heads? (iii) at most 2 heads?
5. During a war, 1 ship out of 9 was sunk in a voyage. What is the probability that exactly 3 of convoy of 6 ships would arrive safely using binomial distribution?
6. The probability of components' failure is 0.05. Out of 14 components what is probability that (i) at most 3 will fail (ii) at least 3 will fail? (ANS 0.9958, 0.0301)
7. In a certain factory turning out blades, there is a small chance of 1/500 for any blade to be defective. The blades are supplied in packets of 10. Use the Poisson distribution to calculate the approximate number of packets containing no defective, one defective and two defective blades in a consignment of 10000 packets.
8. The number of accidents in a year attributed to taxi drivers in a city follows Poisson distribution with a mean of 3. Out of 1000 taxi drivers, find approximately the number of drivers with (i) no accidents in a year and (ii) more than 3 accidents in a year.
9. If two cards are drawn from a pack of 52 cards which are diamonds, using Poisson distribution, find the probability of getting two diamonds at least 3 times in 51 consecutive trails of two cards drawing each time. (ANS 0.5768)
10. The weights of 4000 students are found to be normally distributed with a mean of 50 kg and an SD of 5 kg. Find the probability that a student selected at random will have weight (i) less than 45 kg, and (ii) between 45 and 60 kg.  
(ANS (i) 0.1587 (ii) 0.8185)
11. If X is normally distributed with mean and standard deviation 4, find
1.  $P(5 \leq X \leq 10)$ . (ANS 0.3345)
  2.  $P(X \geq 15)$ . (ANS 0.003)
  3.  $P(10 \leq X \leq 15)$ . (ANS 0.0638)

4.  $P(X \leq 5)$ . (ANS 0.4013)
12. If X is normally distributed with mean 30 and standard deviation 45, find
1.  $P(26 \leq X \leq 40)$ . (ANS 0.7653)
  2.  $P(X \geq 45)$ . (ANS 0.0013)
13. In a construction site, 4 lorries unload materials per hour, on an average .What is the probability that the time between arrivals of successive lorries will be (i) at least 20 minutes (ii) less than 20 minutes?
14. A hospital switch receives an average of 4 emergency calls in a 10 minute interval. What is the probability that (i) there are at most 2 emergency call?(ii) there are exactly 3 emergency calls in an interval of 10 minutes? (ANS 0.238, 0.1954)
15. A manufacturer, who produces medicine bottles, find that 0.1 % of the bottles are defective. The bottles are packed in boxes containing 500 bottles. A drug manufacturer buys 100 boxes from the producer of bottles. Using Poisson distribution, find how many boxes will contain (i) no defective bottles and (ii) at least 2 defective bottles( ANS 0.6065, 9)
16. If X is normally distributed with mean 1 and standard deviation 43 , find
1.  $P(3.43 \leq X \leq 6.19)$  (ANS 0.3345)
  2.  $P(-1.43 \leq X \leq 6.19)$  (ANS 0.003)
17. If the weights of 300 students are normally distributed with a mean of 68 kg and a SD of 3 kg, how many students have weights (i) greater than 72 kg? (ii) Less than or equal to 64 kg? (iii) Between 65 kg to 71 kg inclusive? (ANS 28 (ii) 28 (iii) 205)